

Commentary

What It Really Takes: The Costs and Commitments Behind a Successful Coaching Model for Afterschool STEM Educators

Heidi Cian 

Maine Mathematics and Science Alliance, Augusta, ME 04330, USA; hcian@mmsa.org

Abstract

Out-of-school-time (OST) programs in the United States offer significant opportunities for youth to engage with and develop their identities in science, technology, engineering, and mathematics (STEM). However, professional learning that supports OST educators in developing identity-affirming STEM facilitation remains chronically underfunded and undervalued. Dominant approaches to measuring program “costs”—often centered on per-participant expenditures or short-term cost-effectiveness—obscure the systemic, relational, and capacity-building investments required to sustain high-quality OST STEM practices. This commentary examines how available cost frameworks shape what is rendered visible as “value” in OST STEM professional learning and where they fall short. To ground this analysis, I draw on the Afterschool Coaching for Reflective Educators in STEM (ACRES) program, a long-running national coaching initiative, as an illustrative case through which to examine how investments unfold over time and across contexts. Using ACRES, I demonstrate how costs are more productively understood as multidimensional investments in infrastructure, human capacity, relationships, and knowledge—forms of value that resist per-participant or short-horizon accounting. I offer an alternative tool, the Capacity-Based Cost Assessment (CBCA), to facilitate reflection on the outcomes of these investments. I include recommendations for how to define, document, and evaluate investments in OST STEM professional learning.

Keywords: afterschool education; STEM education; professional learning; cost

1. Introduction

Out-of-school time (OST) programs in the United States (U.S.) offer a diverse array of enriching experiences that provide opportunities for youth to engage with and build positive identities in and relationships with science, technology, engineering, and mathematics (STEM). This programmatic diversity is shaped by multiple factors, including the range of funding sources that sustain program operation (e.g., philanthropic, corporate, state, and federal), program formats (e.g., summer programs and camps, afterschool programs), subject matter emphases (e.g., STEM, arts, athletics), and the characteristics of the youth they serve (e.g., age, geographic location, gender identity, cultural community) (McCombs et al., 2017). Such variation extends to the educators who facilitate STEM learning in OST spaces. Educators enter this work with a wide range of expertise spanning academic subject knowledge, social-emotional learning, community engagement, and cultural traditions. They exercise this expertise as they create spaces for meaningful youth STEM engagement (NAA, 2023; Shea et al., 2023).

Within this diverse landscape, professional learning (PL) for OST educators is widely recognized as critical for enabling identity-affirming, equity-centered STEM engagement



Academic Editor: Amber Simpson

Received: 14 January 2026

Revised: 11 February 2026

Accepted: 14 February 2026

Published: 18 February 2026

Copyright: © 2026 by the author.

Licensee MDPI, Basel, Switzerland.

This article is an open access article distributed under the terms and

conditions of the [Creative Commons Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

and sustaining professionals in the field (NAA, 2023). However, OST educator PL remains chronically underfunded and undervalued (Afterschool Alliance, 2024; NAA, 2023). High staff turnover, scheduling misalignments, and absent resources to compensate educators for additional work time make sustained PL participation particularly difficult compared to providing PL for in-school educators (Afterschool Investments, 2007; Yamashiro, 2022). At the same time, tools that could make sense of the costs of OST PL tend to emphasize narrow calculations of per-participant expenditure or efficiency, overlooking the broader systemic and relational investments required to seed, sustain, and scale equity-centered initiatives in these richly complex learning environments.

This commentary argues that dominant cost-effectiveness frameworks—shaped by efficiency- and workforce-oriented policy logics—are poorly suited to OST STEM PL, where the most consequential returns on investment take the form of long-term capacity, relationships, and identity development that rarely materialize in per-participant and short-horizon cost calculations. I illustrate the case for reframing “costs” as multidimensional investments that build infrastructure, human capacity, relationships, and knowledge. To demonstrate this reframing, I draw selectively on examples from the Afterschool Coaching for Reflective Educators in STEM (ACRES) program, a national coaching model led by my organization, the Maine Mathematics and Science Alliance. Since ACRES launched in 2015, it has supported educators in afterschool and other OST settings in developing STEM facilitation skills through synchronous, virtual PL. ACRES is an appropriate case for this review for several reasons. First, as a long-running national initiative with participants from a wide range of OST settings, it illustrates the variability and systemic complexity that shape PL in this sector. Second, its design highlights the very forms of investment often overlooked by conventional cost frameworks: relationship-centered coaching, virtual infrastructure, and capacity-building that extends beyond a single program site or grant cycle. Finally, because ACRES has been supported and studied across multiple funding cycles, it provides a rich evidence base from which to draw examples of how costs and investments manifest in practice. In this way, these features position ACRES as a compelling case to illuminate both the pitfalls of narrow cost calculations and the potential of reframing investments in terms of sustainability and capacity.

By situating ACRES within this conversation, I surface the systemic conditions and diverse forms of investment that are essential to sustaining identity-affirming STEM facilitation. I conclude by offering recommendations for researchers, funders, and policymakers on how to reconceptualize cost analyses and design evaluation frameworks that better account for long-term, systemic value.

2. Methodological Approach

I approach this commentary as a theory synthesis-based conceptual study combined with analytic framework construction and an illustrative case analysis. Following Jaakkola’s (2020) characterization of theory synthesis, I integrate scholarship from cost-effectiveness research and equity-centered OST STEM PL to reconceptualize how “cost” and “return” are understood in OST PL systems. The overarching purpose is to engage with these strands of thought to explore how dominant cost frameworks shape decision-making and advance an alternative analytic perspective that program developers and evaluators may find better aligned with equity-centered, capacity-building work.

This synthesis proceeds in three steps. After attending to the national context in which this inquiry is situated, I develop a critical integration of research on cost and cost-effectiveness in education, with particular attention to how these approaches operate in OST STEM contexts. This review surfaces underlying assumptions about efficiency, measurement, and short-term outcomes that structure existing evaluations. Drawing on

this synthesis, I then construct a conceptual analytic framework by specifying key domains that may guide alternative analyses (Jabareen, 2009). The resulting framework translates the theoretical integration into a structured approach for examining how monetary and non-monetary investments relate to longer-term system capacities. Third, I include an illustrative case application to demonstrate how the framework can be used in practice.

3. Contextual Background—United States OST Programming

In the current U.S. policy environment, debates about educational purpose increasingly translate into debates about value, efficiency, and return on investment—making cost-effectiveness evaluations a central mechanism through which educational priorities are communicated, reinforced, and enacted. Conversations about “effectiveness”—and thus about what constitutes a worthwhile investment—sit on top of long-standing debates about the purposes of education itself. Historically, U.S. schooling has been politically and socially tasked with serving competing aims: preparing citizens for democratic participation (Giroux, 2015), cultivating moral and civic character (McClellan, 1992), and producing a skilled workforce to support economic growth (Burrus et al., 2017). Each aim carries implicit judgments about which outcomes matter to the public and how success ought to be defined and measured. Modern cost-effectiveness frameworks inherit these value commitments. Tools and success expectations designed around quantifiable, workforce-aligned outcomes tend to prioritize metrics such as achievement scores, participation counts, or productivity gains (e.g., in evaluating 21st Century Community Learning Centers, U.S. Government Accountability Office, 2017) while obscuring relational, communal, or identity-centered dimensions of learning. OST STEM PL sits directly in this tension. Its most consequential outcomes (e.g., educators’ capacity to build belonging, youth identity development in STEM, culturally responsive facilitation, and community-engaged practice, McCombs et al., 2017) rarely surface in traditional cost analyses. As a result, the “returns” on OST PL can appear limited or diffuse when evaluated through frameworks not built for these purposes.

Recent federal policy developments sharpen this tension. The 2025 interagency agreements between the U.S. Departments of Labor and Education reconfigure the administration of K-12 and postsecondary programs around a more tightly integrated education–workforce system (U.S. Department of Labor, 2025). Public statements accompanying the agreement emphasize preparing students for “today and tomorrow’s workforce demands” and frame program streamlining as a way to improve alignment with labor market needs. This shift reflects a broader national trend in which the value of educational investments is increasingly judged through their economic contribution and workforce relevance (National Science Foundation, 2025). While such priorities offer one lens for understanding educational impact, they risk marginalizing the relational, identity-centered, and community-embedded dimensions of learning that OST STEM PL is uniquely positioned to support. In this policy climate, cost-effectiveness tools that foreground workforce metrics can obscure the forms of educator capacity—such as belonging-building, cultural responsiveness, and sustained relational practice—that are most consequential for equity-driven OST environments (Shea et al., 2023).

The implications of this emphasis extend into OST systems. Early analyses of the Elementary and Secondary Education Partnership highlight that the 21st Century Community Learning Centers (21st CCLC) program (the primary federal funding stream for afterschool and summer learning) has been folded into the new workforce-aligned administration structure (Ramdial, 2025). While statutory oversight for 21st CCLC remains with the Department of Education, the Department of Labor now manages grant competitions, technical assistance, and alignment with employment and training initiatives. Ramdial (2025) notes that core program functions and funding remain intact, yet the administra-

tive shift signals a reframing: OST programs are being situated within a policy logic that privileges workforce preparation. This reframing raises practical questions about how OST programs—and the PL systems that support them—will be priced, evaluated, and justified when their most salient outcomes do not align cleanly with workforce metrics. For STEM-focused PL efforts, this creates a widening mismatch between the primary outcomes OST education is most suited to cultivate (e.g., identity development, general skill development, exposure to new experiences; McCombs et al., 2017) and the kinds of outcomes emphasized by emerging federal cost and accountability systems.

4. Cost and Cost-Effectiveness in Education Research

Research on educational costs has traditionally emphasized efficiency, often through calculations of cost per participant or cost per unit of learning gain (Levin & McEwan, 2001). In both K-12 and higher education contexts, cost-effectiveness analysis has been promoted as a means of comparing interventions by estimating the cost of achieving a specified outcome, such as test score improvement, graduation rates, or goal attainment (Knight & Skrtic, 2021; Shand et al., 2018; Evans, 2023). Tools such as the Abdul Latif Jameel Poverty Action Lab's (J-PAL) costing template (Bhula et al., 2020) and the Accelerate Cost Tool (Accelerate, 2025) operationalize these approaches by guiding program developers to disaggregate cost categories, link budget items to intended outcomes, and calculate expenditures across a project's lifetime rather than at a single point (International Rescue Committee et al., 2019). These frameworks offer important clarity and comparability, particularly when funders must weigh investment decisions across multiple initiatives.

However, critiques have emerged regarding the limitations of cost-effectiveness frameworks in education, particularly when applied to equity-focused or relationally intensive interventions (Jones et al., 2020; Shand et al., 2018). First, per-participant calculations risk oversimplifying program value by reducing systemic or long-term outcomes to isolated metrics. For example, one trained PL coach may support dozens of educators across years, but cost-per-educator formulas do not account for this multiplier effect (e.g., Knight & Skrtic, 2021). Second, conventional cost-effectiveness analyses often exclude investments that are difficult to quantify but critical for sustainability, such as relationship-building, trust development, and educator networks that persist beyond the life of a grant (Cox et al., 2024). Furthermore, these approaches may inadvertently reinforce inequities by privileging interventions with easily measurable outcomes, thereby undervaluing identity-affirming or community-responsive practices whose impacts unfold over extended timeframes (Cann & DeMeulenaere, 2020; Cox et al., 2024). Finally, these approaches lend themselves to aggregated outcome reports, which may overshadow inequitable outcomes by failing to account for racial, linguistic, or neurodivergent differences (see QuantCrit critiques for data aggregation, e.g., Gillborn et al., 2018).

Even within measurable outcomes, definitions of “effectiveness” may vary. For instance, in Donath et al.'s (2023) meta-analysis of PL for inclusive education, they explored four outcome categories: teachers' knowledge, skills, and beliefs, and students' behavior. However, many other outcome categories could be imagined. In this sense, a mismatch between a cost and outcome category may underestimate or inflate the costs for effectiveness.

Assessing Costs in OST STEM PL

In the OST STEM literature specifically, explicit analyses of costs remain sparse. Studies of PL for OST educators have highlighted barriers for their development and maintenance, such as high staff turnover, misalignment between training schedules and program hours, and insufficient compensation for additional work time (Bouffard & Little, 2004; Allen et al., 2019). Yet few have systematically connected these challenges to cost frameworks or

attempted to quantify the full range of investments required to make OST PL accessible, effective, and sustainable in this unique context. Addressing this gap requires rethinking what counts as “cost” and “return on investment” in identity-affirming STEM initiatives.

While published research has yet to explore this problem, the cost of outcomes is a real and integral part of the operation of many OST programs. For instance, the 21st CCLCs in the United States are federally funded, locally administered programs that are evaluated based on student success metrics such as school attendance, classroom grades, and state assessment scores, and arguments for or against continuing to fund or expanding funding for these programs are contingent on these outcomes (Afterschool Alliance, 2016; Weiss, 2013). Consequently, programs focus resources such as staff PL, youth activity time, and youth engagement materials in directions that are most likely to show annual gains in these outcome areas.

As such, beyond shaping evaluation, cost frameworks actively structure decision-making within OST programs. When funding renewal and legitimacy hinge on a narrow set of measurable outcomes, programs rationally reallocate staff time, PL investments, and instructional priorities toward activities most likely to demonstrate short-term gains. In OST environments, where staffing is often part-time and roles are fluid, this pressure can subtly reshape educators’ work, encouraging compliance with externally legible outcomes over the relational, exploratory, and culturally grounded practices that draw youth into sustained STEM engagement. In this way, cost-effectiveness tools help determine which forms of practice are viable to maintain.

These dynamics are intensified by structural features of OST systems that complicate standard economic analyses. OST programs are characterized by fluctuating enrollment, seasonal participation, variable staffing patterns, and braided funding streams that differ across sites and years. PL investments often span multiple programs, roles, and funding cycles, making it difficult to assign discrete costs to discrete outcomes. A single PL investment may support an educator who moves across programs, mentors/peers, or remains in the field for years—effects that evade annualized per-participant calculations. As a result, OST PL frequently appears inefficient or expensive when evaluated using tools designed for more stable, institutionally bounded systems such as schools or universities.

The consequences of this mismatch are often subtle but consequential. Misaligned cost frameworks can contribute to program drift, where identity-affirming, justice-oriented, or community-engaged goals are gradually deprioritized in favor of activities that align more directly with funder-defined metrics. For instance, funder-driven evaluation in informal science learning institutes has often emphasized attendance counts, demographic reach, and immediate learning artifacts (e.g., pre/post surveys, exhibit dwell time). This emphasis can subtly redirect staff labor toward programs that maximize throughput and measurable engagement, while relationship-rich, community-partnered, or iterative co-design work becomes harder to sustain, even when these approaches are central to institutional equity missions (Dawson, 2014, 2019). Over time, this drift can erode the very conditions (e.g., educator trust, cultural responsiveness, and relational continuity) that research has shown to be essential for meaningful STEM identity development in OST settings (Shea et al., 2023; McCombs et al., 2017). From this perspective, the central challenge is not simply that the costs of OST STEM PL are difficult to quantify in relation to impact, but that prevailing cost frameworks inadequately capture the kinds of investments required to sustain equitable practice in complex learning ecosystems. This analysis suggests that the challenge facing OST STEM PL is not merely technical but conceptual: without frameworks that recognize capacity-building and relational investment as legitimate forms of value, cost analyses will continue to misrepresent both the effectiveness and sustainability of equity-centered practice.

5. ACRES as a Case of Systemic Investment in OST STEM PL

I selected ACRES as an illustrative case for interrogating the cost of OST STEM PL because it represents a long-running, multi-site, nationally scaled OST coaching model that has evolved across more than a decade of implementation. Its development has been supported by multiple funding streams and documented through longitudinal participation and infrastructure data, making it particularly well-suited for examining how investments accumulate, interact, and translate into system-level capacity longitudinally. While ACRES offers analytic advantages for tracing these dynamics, it is also a relatively well-resourced and nationally visible initiative. As outlined below, its investment profile and organizational supports differ from those of smaller, less formal, or locally bounded OST programs. Accordingly, ACRES is presented here as an analytically strategic case rather than as a representative model of all OST PL efforts.

My affiliation with the organization that developed ACRES, combined with my role as the project's lead researcher, provides direct access to detailed financial, participation, and programmatic records. While this insider perspective enables a rich, granular view of funding flows, staffing patterns, and longitudinal program operations, it also requires careful analytic reflexivity to avoid overemphasizing the program's strengths or interpreting outcomes through a personal lens. I endeavor to anchor all claims used to illustrate the point of cost effectiveness calculations in documented evidence, and I use ACRES as illustrative of systemic investment dynamics in OST STEM PL rather than as a judgment of program quality or comparative effectiveness.

5.1. ACRES Model

ACRES is a virtual coaching model in which afterschool and other OST educators meet in small cohorts (generally of 3 to 8 people), record videos of themselves facilitating STEM activities, and discuss these videos with peers and a trained coach across three sessions. OST professionals across program types, geographies, and roles have participated in sessions, including seasoned educators and those new to the field, site leaders and youth-facing professionals, and professionals working in programs serving youth preK through postsecondary settings. While this reach makes ACRES exceptional in the breadth of its applicability, it also highlights the fundamental applicability of its focal skills across contexts. ACRES coaching includes modules in skills such as Asking Purposeful Questions, Nurturing STEM Identity and Making Career Connections, and Elevating Youth Voice and Choice.

5.2. ACRES' Funding History

ACRES developed through a sequence of interlocking investments, with different funders enabling distinct forms of work (see Figure 1). An initial investment from the Noyce Foundation in 2014 supported piloting, which included designing a relationship-centered coaching model and cultivating a small core of PL coaches who could test and refine facilitation practices within authentic OST settings. In 2015, funding from the STEM Next Opportunity Fund enabled expansion beyond the pilot, including developing additional skill modules, compensating new coaches' training and facilitation, and the labor required to offer additional cohorts to educators.

In 2017, a National Science Foundation (NSF) grant supported a different phase of development which focused on strengthening and studying the ACRES model. This funding enabled MMSA to train additional coaches, develop new impact assessments, and support educators serving rural afterschool programs and libraries. During this period, ACRES also adapted in response to system-level disruption, including the development of a module focused on virtualizing OST programs during the COVID-19 pandemic.

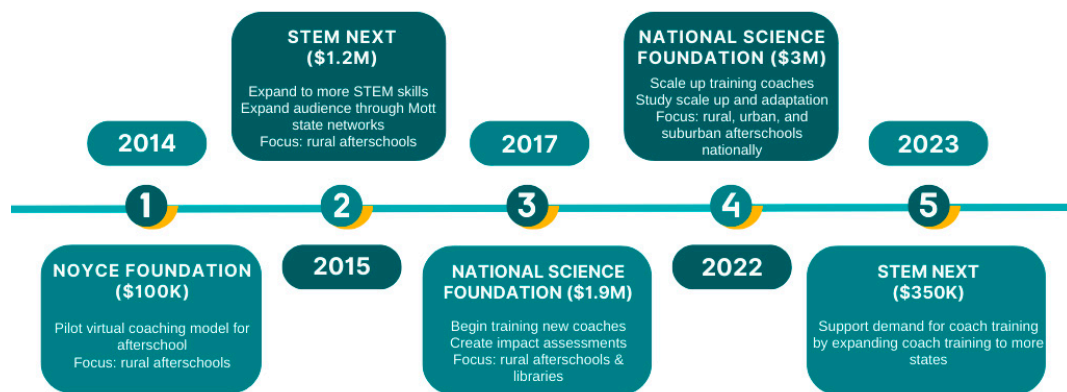


Figure 1. ACRES funding timeline.

Beginning in 2022, a second NSF grant supported a national scale-up of ACRES, shifting the emphasis toward expanding coach preparation and educator participation across new national regions and in suburban and urban contexts. As ACRES grew geographically under this funding, an additional investment from STEM Next filled critical gaps by underwriting labor and participation costs not allowable under NSF constraints, particularly those associated with compensating additional coaches to meet the expressed demand for coach training in the ACRES model. STEM Next support also opened new dissemination pathways by embedding ACRES within a national portfolio, creating opportunities to share the model and emerging lessons through venues such as the STEM Next annual conference. This period of expansion (covering the NSF and STEM Next funding) required new forms of infrastructure investment, including partnerships with state afterschool networks in Illinois, New York, and North Carolina, as well as more robust systems for tracking coaches, educators, participation, and demographics. These systems became essential for monitoring alignment with funder and partner commitments and ensuring appropriate compensation and necessitated additional time from MMSA's organizational finance and administrative staff.

This timeline illustrates that, rather than following a fixed implementation script, ACRES evolved in response to demand, uneven institutional capacity, and high educator turnover—conditions that are endemic to OST systems. By 2025, our records indicate that 97 coaches had been prepared to facilitate ACRES sessions, with cohorts led by MMSA staff and trained coaches reaching 1486 educators across all 50 states. Even as an illustrative estimate, this scale highlights how investments in distributed coaching capacity can reverberate beyond direct participants, shaping STEM learning experiences for tens of thousands of youth annually (approximately 29,720, assuming 20 youth per educator; see anonymized citation).

5.3. Calculating the Cost of ACRES-Problems with Simple Approaches

Figure 1 shows that, over ten years, diverse funding sources have contributed approximately \$6.2 million toward ACRES. These investments supported the development of a PL module library, preparing coaches and educators, and creating open-access resources and microcredential badges. The program's reach is further reflected in at least 26 research and practitioner publications, conference presentations, and newsletter articles (anonymized citation). From the perspective of traditional cost-effectiveness frameworks, these expenditures would be expected to be disaggregated, linked to a defined set of outcomes, and aggregated into a per-participant estimate to enable comparison across interventions (Bhula et al., 2020; Shand et al., 2018).

When applied to ACRES, however, this logic quickly breaks down. A simple division of total funding by the number of participating educators (\$6.2 million $\div$ 1486 educators = \$4172 per educator) rests on two assumptions embedded in many costing tools: first, that program value can be reduced to outcomes experienced by directly enrolled participants; and second, that participation can be fully enumerated within a bounded reporting system. Both assumptions are problematic in the context of ACRES. Coaches frequently enroll educators through their own local systems, resulting in participation that is not captured in centralized records, and the program has generated substantial outputs that extend beyond cohort-based participation, including research publications, national dissemination to researchers and practitioners, and data infrastructure that supports subsequent funding and program development. In this way, the very features that cost-effectiveness tools are designed to surface (i.e., clear attribution between spending and outcomes) are misaligned with how value is produced in long-running, capacity-building OST PL initiatives. Over-simplified per-educator calculations thus risk obscuring ACRES' broader contributions and may produce "sticker shock" for potential funders by severing costs from the systems they were designed to build.

6. A Reframed Cost Calculation

In response to this difficulty, I reframe the notion of "cost" by examining ACRES as an investment in sustainable identity-affirming systems rather than as a discrete, time-bound intervention. Traditional cost analyses often treat the question "What does it cost?" as shorthand for "How much money does it cost?", a framing that privileges easily quantifiable, short-term expenditures while obscuring the labor, time, and relational work required to sustain effective practice beyond salaried hours or single funding cycles. In contrast, my reframing asks: "What systemic supports are necessary to enable OST educators to affirm young people's STEM identities, and what forms of investment make those supports possible?" This shift foregrounds how monetary, temporal, and relational resources accumulate over time to build durable capacity across multiple programs, cohorts, and networks. Framing ACRES in this way moves attention away from per-participant dollar calculations toward the broader infrastructure, human capacity, relationships, and knowledge that make sustained, equity-centered STEM facilitation in OST programming possible. These investments often carry substantial upfront costs but yield long-term, system-level returns that conventional cost-effectiveness tools struggle to capture.

6.1. Defining Investment Categories

One critical category of investment involves infrastructure: the systems and resources that make participation feasible, reliable, and low-friction for educators and coaches working in highly variable OST contexts. In ACRES, this has included developing and maintaining a centralized digital home for the PL model (i.e., <https://sites.google.com/mmsa.org/acres-coaches-corner/home>, accessed on 13 February 2026), where coach guides, exemplar videos of practice, and facilitation tools are curated and updated over time. Infrastructure investments also encompass creating participation-tracking systems capable of monitoring educator and coach engagement, dosage, and demographic patterns—systems that became increasingly necessary as the program expanded in scope and complexity. Additional infrastructure supports, such as providing video conferencing accounts for coaches and maintaining participation records needed to administer stipends accurately, rarely appear in per-participant cost calculations, yet are essential for ensuring access, accountability, and continuity at scale.

A second category centers on human capacity investments, which are directly tied to developing the skills, judgment, and adaptability required for high-quality coaching

and STEM facilitation. In ACRES, this has included training and providing ongoing, individualized support to regional coaches—not only in focal PL content, but also in educator recruitment and retention, facilitation across diverse OST settings, and adapting modules in response to local cultural and institutional contexts. Human capacity investments also extend inward, encompassing the development of MMSA staff expertise in coordinating national-scale initiatives, conducting practice-embedded research, navigating evolving technologies (including video-based conferencing and artificial intelligence), and sustaining relationships across geographically dispersed partners. These forms of learning are cumulative and recursive: they deepen over time and shape the quality of future cohorts, even though they are difficult to attribute to any single outcome metric.

Relationship investments form a third dimension. Sustaining ACRES has required deliberate, ongoing work to build trust and shared purpose among individuals and institutions operating across different regions, funding structures, and professional cultures. This includes cultivating relationships with state afterschool networks, maintaining open and reciprocal communication with current and prospective funders, and engaging national associations that influence the broader OST ecosystem. Relationship-building has also occurred among participants themselves through efforts to foster peer connection and professional community via online groups, communities of practice (CoPs), and storytelling through newsletters and biannual meetings. These investments demand time and emotional labor that are central to sustaining engagement, reducing attrition, and supporting identity-affirming practices in a sector with a workforce marked by turnover and precarity (NAA, 2023).

Finally, ACRES has required sustained knowledge investments, or generating, synthesizing, and disseminating insights that inform the program itself and the wider field. Over time, this has included developing over two dozen research and practitioner-facing publications and presentations, creating and deploying open-access resources for coach preparation and educator PL, and collecting qualitative and quantitative evidence that can be leveraged to advocate for OST PL more broadly. These knowledge products extend the value of ACRES beyond enrolled participants, shaping discourse, informing policy conversations, and supporting future funding for related initiatives.

Taken together, infrastructure, human capacity, relationships, and knowledge investments collectively support the sustainability of the ACRES model. Including sustainability as an additional investment category highlights the deliberate, long-term orientation of OST PL initiatives, drawing attention to how short-term expenditures and efforts compound over time to produce enduring system-level effects. It prompts consideration not just of immediate outputs or participation but also how investments in infrastructure, human capacity, relationships, and knowledge interact to maintain program viability, adaptability, and impact beyond discrete funding cycles.

6.2. Recalculating the “Cost” of PL

Taken together, these investment categories point toward a practical alternative to per-participant cost calculations that evaluates PL by the capacity it builds and the durability of the systems, its legacy systems. Rather than asking how much was spent per educator reached during a grant period, this approach treats PL as a set of layered investments whose returns compound over time through multiplier effects. From this perspective, the relevant unit of analysis is not the individual participant but the system’s expanded ability to sustain identity-affirming practice.

To operationalize this reframed approach to cost, I propose a Capacity-Based Cost Assessment (CBCA) that funders and evaluators can use in place of, or alongside, per-participant cost calculations (Table 1). The CBCA treats cost as an investment in system-

level capacity and documents what persists, who is enabled, and how influence multiplies over time. The CBCA may be used in multiple ways, including (a) by funders during proposal reviews to evaluate the strength of logic connecting funding and resource requests with promised deliverables; (b) by project leaders in annual reports to show progress, demonstrate resource use, and support requests for modifying plans or resource allocation; and (c) by administrators to compare PL programs and select one to invest their employees' time and intellectual capital. For each of the capacity dimensions defined in Section 5.1 above, Table 1 defines the evaluation focus, provides some examples of evidence that can be used to understand program capacity within that dimension, and lists four developmental stages that may define a program's status at a given evaluation period. Table 1 also includes a dimension for "sustainability", recognizing this as a significant element of a PL program's value that results from intentional investment in the other capacity dimensions.

Table 1. The CBCA includes five aspects and describes stages of development within each aspect.

Capacity Dimension	Evaluation Focus	Examples of Evidence	Stages of Development
Infrastructure	The extent to which the program builds durable systems that support ongoing participation and learning	Reusable curricula or PL modules; Technology platforms; Credentialing or coaching pathways; Data and tracking systems; Administrative processes that reduce future startup costs	Grant-bound: Infrastructure is tightly coupled to a single funding cycle Reusable: Tools persist but require substantial reinvestment or adaptation to maintain Durable: Infrastructure supports multiple cohorts or programs with modest upkeep Field-facing: Infrastructure is adopted or adapted by external organizations and integrated in existing systems
Human Capacity	How the program multiplies expertise, leadership, and facilitation skills over time	Number and roles of coaches or leaders trained; Leadership responsibilities assumed post-project; Evidence of skill transfer across sites or cohorts	Individual: Skills remain localized to the original participants Distributed: Participants apply skills within their own settings Multiplying: Participants support others in developing skills across sites or cohorts Generative: Participants shape practice, mentoring, or PL beyond the program
Relational	The strength and durability of relationships that increase program resilience and reach	Formal partnerships; Intermediary relationships; Communities of practice; Evidence of trust-building or sustained coordination	Transactional: Relationships are time-limited and task-specific Sustained: Relationships continue informally after project activities end Collaborative: Partners engage in ongoing joint work Networked: Relationships reconfigure how organizations coordinate, share resources, or make decisions
Knowledge	The extent to which the program generates knowledge that informs future work in the field	Publications; Practitioner resources; Conference presentations; Datasets; Conceptual frameworks or models	Internal: Knowledge is undocumented or locally held Shared: Knowledge is disseminated to a limited, narrowly-defined audience Applied: External organizations use or adapt program-generated knowledge Influential: Knowledge informs field discourse, funding priorities, or policy
Sustainability	How well practices are positioned to persist and evolve	Continued implementation post-grant; Adaptations by new sites; Spinoff funding; Institutionalization within partner organizations	Time-limited: Practices end with funding Partial: Practices persist in isolated settings Embedded: Practices are integrated into routine operations Norm-shifting: Practices redefine expectations or standards within the system

6.3. How to Use the CBCA

The CBCA produces a capacity profile that reveals how and where value is generated. This capacity profile is a structured representation of how investments (monetary and non-monetary) translate into durable system capacities across five domains: Infrastructure, Human Capacity, Relationships, Knowledge, and Sustainability. It links inputs (e.g., funding, staff time, coach labor, technology costs, and administrative effort) to evidence and long-term systemic impact. Using ACRES as an example, I can outline inputs that connect to each domain, determine relevant artifacts to examine, and translate that evaluation into a capacity rating using the Stages of Development in Table 1. Table 2 includes some non-exhaustive examples and evidence to illustrate the possible use of the CBCA. The Systemic Return column includes some potential indicators that program staff can continue to monitor as ACRES' funding winds down over the next calendar year (i.e., 2026). In this way, the Systemic Return column includes possible metrics to monitor rather than precisely measured outcomes.

Table 2. The CBCA applied to ACRES.

Capacity Dimension	Inputs (Examples)	Evidence (Examples)	Capacity Stage	Systemic Returns (Examples)
Infrastructure	\$50k in infrastructure contracts; 0.5 FTE staff development and maintenance	PL module library; Participant tracking system; Credentialing pathways	Field-facing: Reusable across cohorts and programs, not grant-limited	100 modules reused by 20 cohorts/year; supports multiple coaches and educators
Human Capacity	\$40k coach stipends; 2.0 FTE	Trained 97 coaches; Coach support sessions; Train-the-trainer model	Multiplying: Coaches support others within their programs and more broadly	Each coach trains ~15 educators/year; each educator reaches ~20 youth → ~29,720 youth/year
Relational	\$150k to support state networks	State afterschool network agreements; CoPs; Newsletters	Collaborative: Partnerships persist; Moderate network reshaping	3 state networks maintain engagement; relationships enhance recruitment and retention
Knowledge	\$30k in research stipends; 1.5 FTE	Open-access tools; Conference presentations	Influential: knowledge used externally; influences field norms	Resources adopted by 10 external programs; Informs policy/funding
Sustainability	\$25k website and resource development; 1.0 FTE	Implementation beyond grant; Spinoff funding; Institutionalization	Embedded: practices embedded in multiple organizations	Practices continue in 10+ partner orgs post-funding

To apply the CBCA to a PL initiative, the analysis can be conducted at multiple points across a project's lifecycle (e.g., prior to implementation, at intervals during implementation, and at the project's conclusion), allowing stakeholders to examine how capacity is being built, sustained, and leveraged over time.

Before a project begins, the CBCA can be used prospectively to support planning and resource budgeting decisions. At this stage, program developers (alongside relevant partners such as funders, if appropriate) identify the full range of anticipated investments that will support the program, including both monetary costs and non-monetary contributions such as staff time, coaching effort, partner engagement, or volunteer support. These inputs can be mapped onto the five CBCA domains to clarify how proposed resources are intended to build infrastructure, human capacity, relationships, knowledge, and long-term sustainability. Artifacts at this stage may include grant proposals, logic models, staffing plans, partnership agreements, and draft curricula or tools. Applying the Stages of Development proactively allows teams to articulate which investments are expected to support

grant-specific activities and which intentionally seed reusable, durable, or field-facing capacity. This clarification makes assumptions about scale and sustainability explicit from the outset. In this way, proactive use of the CBCA can be part of a grant application to show the long-term viability and benefits of a proposed initiative.

During implementation, the CBCA can be revisited at key transition points, such as when new funding is introduced, funding streams expire, partnerships shift, or program design evolves. At these mid-course moments, project leaders inventory current investments (again including monetary and non-monetary contributions) and map them onto the five domains to reflect how resources are being deployed in practice. Evidence gathered at this stage may include training materials, participation and dosage data, coaching logs, updated partnership agreements, and emerging knowledge products. Using the Stages of Development, teams assess whether capacity in each domain remains grant-specific or is becoming increasingly reusable, durable, or field-facing. Interpreting these patterns supports formative sensemaking about systemic returns, such as whether expertise is being multiplied, networks are strengthening, or practices are becoming embedded beyond the initial funding context. Keeping a longitudinal record of these assessments can help program leaders illustrate growth in capacity over time and make a strong case for additional investment in key areas. For instance, a formative assessment may show high relational growth but infrastructure capacity that is inadequate to support that relational development long-term, which would signal a need to shift resources to infrastructure development.

At the conclusion of a project, the CBCA can be applied summatively to examine the cumulative capacity generated through the initiative. At this stage, the focus shifts from anticipated or in-progress investments to those that were fully realized, drawing on comprehensive artifacts such as finalized curricula, PL resources, reports, open-access tools, and documented partnerships. Mapping these investments across the five domains and rating them using the Stages of Development enables project leaders to characterize what forms of capacity persist beyond the grant period and how they may continue to generate value. Interpreting these results foregrounds systemic returns, including sustained practices, durable infrastructure, expanded networks, and knowledge that can influence broader field or policy decisions.

Used iteratively across the project lifecycle, the CBCA produces a structured capacity profile that captures the full value of a PL initiative beyond per-participant cost metrics. This lifecycle approach supports strategic decision-making by helping partners such as funders identify when and where investments are yielding durable and field-facing returns, and where additional or different investments may be needed to support adaptation, sustainability, and scaling.

6.4. Comparing the CBCA to Existing Cost Assessment Approaches

The CBCA builds on the logic of existing cost and cost-effectiveness approaches by linking inputs to outcomes and making investments explicit, while explicitly addressing the conceptual and structural limitations identified in OST STEM PL. Similar to tools such as J-PAL's costing template (Bhula et al., 2020) or the Accelerate Cost Tool (Accelerate, 2025), the CBCA begins by cataloging financial and human inputs and connecting them to program outputs (actual or anticipated, depending on when it is used). However, it diverges in three critical ways. First, it extends beyond per-participant calculations to capture multiplier effects, showing how a single trained coach or educator can influence multiple cohorts, programs, and youth over time. Second, it incorporates investments often invisible in traditional frameworks, including relational work, trust-building, and knowledge generation, situating these alongside monetary costs. Third, it uses hierarchical

indicators (e.g., grant-bound to field-facing) to assess durability and systemic impact, highlighting which program elements are likely to persist or scale.

However, the CBCA is neither simple nor formulaic. Producing a capacity profile in this way requires careful documentation, interpretation of diverse evidence, and judgment about how different investments translate into system-level returns. Unlike per-participant cost metrics, the framework does not yield tidy dollar-to-outcome ratios that can be easily compared across programs. Instead, it surfaces patterns, trade-offs, and leverage points, offering a more nuanced, qualitative sense of value that can guide strategic investment and reflection. In this way, the CBCA provides a practical lens for understanding the full scope of costs and returns in OST STEM PL while making clear that assessing systemic and long-term value is inherently more complex than conventional cost-effectiveness calculations suggest. In practice, the CBCA can be paired with traditional per-participant or cost-per-outcome calculations to provide a fuller picture: the quantitative metrics offer comparability and benchmarking across initiatives, while the CBCA illuminates systemic, relational, and long-term returns that conventional metrics overlook. Using both approaches together allows funders, program leaders, and policymakers to contextualize short-term efficiency within broader investments in capacity, equity, and sustainability.

6.5. Boundaries of Use and Limitations

The CBCA is intended as a heuristic evaluative framework rather than a standardized measurement instrument. Its goal is to support structured reflection and reasoning about system-level capacity and investment patterns, rather than to produce precise scores. In this way, it is not suited for evaluating or comparing programs. Assigning stages of development relies on the evaluator's judgment, which introduces subjectivity. However, this subjectivity is by design; it is an opportunity for evaluators to engage deeply with the evidence, make assumptions explicit, and surface nuances that numeric scores often obscure.

In practice, users can approach subjectivity by documenting the rationale for each rating, triangulating across multiple sources of evidence, and engaging multiple evaluators when possible. For example, when assessing the "Relationships" domain, an evaluator might draw on meeting notes, coach logs, and participant surveys to judge whether networks are active beyond the life of a single cohort. Rather than choosing a single "correct" rating, evaluators can annotate why a stage was assigned, note areas of uncertainty, and consider alternative interpretations. This process encourages discussion and reflection between program leaders, funders, and other relevant interest holders, allowing patterns to emerge and systemic strengths and gaps to be made explicit.

The CBCA is best understood as a tool for reasoned judgment rather than precise measurement. It can inform program planning, within-program funding allocations, or research by highlighting where investments support durable capacities, revealing which areas may require further attention, and suggesting where short-term outcomes may underestimate long-term value. While it can be paired with conventional per-participant or cost-effectiveness analyses to provide additional context, its primary contribution lies in capturing dimensions of relational, human, and infrastructural investment that numeric frameworks cannot easily quantify. Future research should explore how CBCA can complement traditional cost-effectiveness approaches, how evaluators apply the framework in varied settings, and how insights from CBCA can reliably and equitably inform funding, policy, and program planning decisions.

7. Conclusions

Reframing "cost" in informal STEM PL requires shifting attention from per-participant calculations to the systemic investments that make sustained, equity-centered practice pos-

sible. Monetary, temporal, and relational resources accumulate over time to build durable infrastructure, human capacity, relationships, and knowledge across programs, cohorts, and networks. When evaluation frameworks ignore these dimensions, they risk undervaluing the labor and coordination that underpin long-term, identity-affirming STEM facilitation.

For funders and policymakers, this means explicitly budgeting for and tracking investments in infrastructure, coach training, and relationship-building (in other words, not just short-term outputs or attendance metrics) and considering multi-year grants that allow PL programs to build and sustain capacity. For PL leaders, it means designing initiatives that document and share knowledge products, track the ripple effects of trained coaches, and invest in relational and organizational systems that endure beyond individual sessions. For researchers, it signals the need to measure and report on these broader dimensions of investment and impact, generating evidence that captures systemic value rather than isolated outcomes.

Funding: This work described in this manuscript was funded by the STEM Next Opportunity Fund and the National Science Foundation (DRL-2115229).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study.

Acknowledgments: During the preparation of this manuscript/study, the author used Chat GPT 4.1 to help convert ideas into organized manuscript text, to advise more logical organization, to recommend resources to cite, and to advise on reviewer-suggested revisions. The author has reviewed and edited the output, including identifying and reviewing all suggested resources, and takes full responsibility for the content of this publication.

Conflicts of Interest: The author declares no conflicts of interest. The funders had no role in the writing of the manuscript or in the decision to publish the review.

References

- Accelerate. (2025, February 7). *Conducting cost analysis of tutoring interventions: A guide for program providers and researchers*. Accelerate. Available online: <https://accelerate.us/cost-tool/> (accessed on 13 February 2026).
- Afterschool Alliance. (2016, May). *21st Century Community Learning Centers: Providing afterschool and summer learning support to communities nationwide*. Available online: <https://afterschoolalliance.org/documents/21stCCLC-Overview-May2016.pdf> (accessed on 13 February 2026).
- Afterschool Alliance. (2024, March). *Afterschool and summer learning workforce policy recommendations*. Available online: <https://www.afterschoolalliance.org/documents/Workforce-Policy-Recommendations-in-NAA-Framework.pdf> (accessed on 13 February 2026).
- Afterschool Investments. (2007, September). *Building professional development systems for the afterschool field*. U.S. Department of Health & Human Services-Administration for Children and Families. Available online: https://www.afterschoolnetwork.org/sites/main/files/file-attachments/pd_systems.pdf (accessed on 13 February 2026).
- Allen, P. J., Chang, R., Gorrall, B. K., Waggenspack, L., Fukuda, E., Little, T. D., & Noam, G. G. (2019). From quality to outcomes: A national study of afterschool STEM programming. *International Journal of STEM Education*, 6(1), 37. [CrossRef]
- Bhula, R., Mahoney, M., & Murphy, K. (2020). *Conducting cost-effectiveness analysis (CEA)*. J-PAL. Available online: <https://www.povertyactionlab.org/resource/conducting-cost-effectiveness-analysis-cea> (accessed on 13 February 2026).
- Bouffard, S., & Little, P. M. D. (2004). *Promoting quality through professional development: A framework for evaluation (Issues and opportunities in out-of-school time evaluation brief no. 8)* (Harvard Family Research Project). ERIC.
- Burrus, J., Mattern, K., Naemi, B. D., & Roberts, R. D. (Eds.). (2017). *Building better students: Preparation for the workforce*. Oxford University Press.
- Cann, C., & DeMeulenaar, E. (2020). *The activist academic: Engaged scholarship for resistance, hope, and social change*. Myers Education Press.
- Cox, T., Stafford, E., Early, E., Lerman, L., Thompson, T., Toro, S., & Torres-Gerald, L. (2024). *Guidelines for equitably scaling informal STEM programs*. National Girls Collaborative Project. Available online: <https://ngcproject.org/ScalingInformalSTEMPrograms> (accessed on 13 February 2026).
- Dawson, E. (2014). "Not designed for us": How science museums and science centers socially exclude low-income, minority ethnic groups. *Science Education*, 98(6), 981–1008. [CrossRef]

- Dawson, E. (2019). *Equity, exclusion & everyday science learning*. Routledge.
- Donath, J. L., Luke, T., Graf, E., Tran, U. S., & Gotz, T. (2023). Does professional development effectively support the implementation of inclusive education? A meta-analysis. *Educational Psychology Review*, 35(30), 1–28. [CrossRef]
- Evans, D. (2023, February 22). *Cost analysis for education projects: Resources and reflections*. Center for Global Development. Available online: <https://www.cgdev.org/blog/cost-analysis-education-projects-resources-and-reflections> (accessed on 13 February 2026).
- Gillborn, D., Warmington, P., & Demack, S. (2018). QuantCrit: Education, policy, ‘big data’ and principles for a critical race theory of statistics. *Race Ethnicity and Education*, 21(2), 158–179. [CrossRef]
- Giroux, H. A. (2015). *Schooling and the struggle for public life: Democracy’s promise and education’s challenge*. Routledge.
- International Rescue Committee, World Bank Group & Strategic Impact Evaluation Fund. (2019, March). *Capturing cost data*. Available online: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099010824210029041/p152175110a7080861b9aa11ddde50bf4ef> (accessed on 13 February 2026).
- Jaakkola, E. (2020). Designing conceptual articles: Four approaches. *AMS Review*, 10(1), 18–26. [CrossRef]
- Jabareen, Y. (2009). Building a conceptual framework: Philosophy, definitions, and procedure. *International Journal of Qualitative Methods*, 8(4), 49–62. [CrossRef]
- Jones, D. E., Bierman, K. L., Crowley, D. M., Welsh, J. A., & Gest, J. (2020). Important issues in estimating costs of early childhood educational interventions: An example from the REDI program. *Children and Youth Services Review*, 107, 104498. [CrossRef] [PubMed]
- Knight, D. S., & Skrtic, T. M. (2021). Cost-effectiveness of instructional coaching: Implementing a design-based, continuous improvement model to advance teacher professional development. *Journal of School Leadership*, 31(4), 318–342. [CrossRef]
- Levin, H. M., & McEwan, P. J. (2001). *Cost-effectiveness analysis: Methods and applications* (Vol. 4). Sage.
- McClellan, B. E. (1992). *Schools and the shaping of character: Moral education in America, 1607–present*. ERIC Clearinghouse for Social Studies/Social Science Education.
- McCombs, J., Whitaker, A., & Yoo, P. (2017). *The value of out-of-school time programs*. Rand Corporation.
- National Afterschool Association. (2023). *Core knowledge, skills & competencies for out-of-school time professionals*. Available online: https://cdn.ymaws.com/naaweb.org/resource/collection/F3611BAF-0B62-42F9-9A26-C376BF35104F/NAA_Core_Knowledge_Skills_Competencies_for_OST_Professionals_rev2023.pdf (accessed on 13 February 2026).
- National Science Foundation. (2025). NSF STEM K-12. (NSF 25-545). Available online: <https://www.nsf.gov/funding/opportunities/stem-k-12-nsf-stem-k-12> (accessed on 13 February 2026).
- Ramdilal, S. (2025, November 18). *New agreement moves core functions of 21st century community learning centers to dept of labor*. Afterschool Alliance. Available online: https://www.afterschoolalliance.org/afterschoolSnack/New-agreement-moves-core-functions-of-21st-Century-Community_11-18-2025.cfm (accessed on 13 February 2026).
- Shand, R., Muroga, A., Rodriguez, V., & Levin, H. M. (2018). *REACH cost analysis report*. Teachers College Columbia University: Office of School & Community Partnerships. Available online: <https://repository.upenn.edu/server/api/core/bitstreams/351f4d73-49de-4a87-bcca-2a3bb9479c40/content> (accessed on 13 February 2026).
- Shea, M. V., Jurow, A. S., Schiffer, J., Escudé, M., & Torres, A. (2023). Infrastructural injustices in community-driven afterschool STEAM. *Journal of Research in Science Teaching*, 60(8), 1853–1878. [CrossRef]
- U.S. Department of Labor. (2025, November 18). *US departments of labor, education announce new elementary, secondary, and postsecondary partnerships* [Press Release]. U.S. Department of Labor. Available online: <https://www.dol.gov/newsroom/releases/osec/osec20251118> (accessed on 13 February 2026).
- U.S. Government Accountability Office. (2017, April 26). *K-12 education: Education needs to improve oversight of its 21st Century program* (GAO-17-400). Available online: <https://www.gao.gov/products/gao-17-400> (accessed on 13 February 2026).
- Weiss, H. (2013). Fifteen years of evaluation of 21st Century Community Learning Centers: A driver for program quality and capacity in the field. In T. K. Peterson (Ed.), *Expanding minds and opportunities: The power of afterschool and summer learning for student success*. Collaborative Communications Group.
- Yamashiro, N. (2022, January 27). *Staffing takes top spot as primary challenge for afterschool program providers in new survey*. Afterschool Alliance. Available online: https://www.afterschoolalliance.org/afterschoolsnack/Staffing-takes-top-spot-as-primary-challenge-for-afterschool_01-27-2022.cfm#:text=When%20asked%20about%20the%20challenges,hiring%20and/or%20retaining%20staff (accessed on 13 February 2026).

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.